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Pilot Study: Effectiveness of a Nurse-Led Intervention on Biophysical and Biochemical Parameters in Adolescent Girls with Menstrual Irregularities

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Abstract **Background:** Menstrual irregularities are common among adolescent girls and are often influenced by stress, poor nutrition, and sedentary habits. These lifestyle factors can disrupt hormonal balance and metabolic function, leading to irregular menstrual cycles. **Aim:** The aimed to evaluate the effectiveness of a nurse-led intervention on selected biophysical and biochemical parameters among adolescent girls with menstrual irregularities. **Methodology:** The study utilized a quantitative approach with pre-experimental design. The study was conducted among 20 adolescent girls aged 12–18 years attending the Gynecology OPD at Government Thoothukudi Medical College Hospital. Data were collected using structured tools assessing demographic details, menstrual patterns, BMI, and laboratory parameters. **Results:** The results showed a significant reduction in BMI, indicating improved weight status. Levels of hemoglobin and white blood cells increased significantly, suggesting enhanced hematologic function. Biochemical improvements were also noted in triglyceride and triiodothyronine (T3) levels, while other physiological and biochemical parameters remained stable. **Conclusion:** The nurse-led intervention effectively improved BMI, hematological, and biochemical parameters among adolescent girls with menstrual irregularities.

Key Words Menstrual Irregularities, Adolescent Girls, Biophysical Parameters

INTRODUCTION

Menstrual irregularities among adolescent girls are increasingly recognized as a significant public health concern, often influenced by lifestyle factors such as academic stress, irregular sleep patterns, and unhealthy dietary habits. Research indicates that poor management of these factors contributes to menstrual disturbances, affecting approximately 19% of adolescent girls in certain populations, including students [1,2]. Elevated levels of perceived stress, particularly in academically demanding environments, can disrupt the hypothalamic-pituitary-ovarian axis, resulting in menstrual dysfunction [3,4].

Body Mass Index (BMI), a critical indicator of nutritional status, is directly associated with menstrual health. Elevated BMI levels, especially among females, have been linked to irregular menstrual cycles and hormonal imbalances, including polycystic ovary syndrome (PCOS) [5]. Furthermore, biochemical parameters such as serum hormone levels are influenced by dietary intake and metabolic health, factors that play crucial roles during adolescence [6,7].

Nurse-led interventions that promote lifestyle modifications, including balanced nutrition and regular physical activity, have proven effective in improving BMI and biochemical parameters. These interventions help maintain hormonal balance and reduce the prevalence of menstrual irregularities among adolescent girls [8,9].

While previous studies have examined links between BMI, biochemical markers, and menstrual irregularities, few have evaluated nurse-led interventions that address these factors among adolescent girls in clinical settings. Limited evidence exists on how such interventions influence both physiological and biochemical outcomes, particularly in the Indian context. This gap highlights the need for targeted research to assess the effectiveness of nurse-led programs in improving menstrual health through lifestyle and metabolic regulation. Therefore, this study study aimed to evaluate the effectiveness of a nurse-led intervention in improving biophysical, haematological, and biochemical parameters among adolescent girls with menstrual irregularities.

Objectives

- Assessment of the Physiological parameters, haematological parameters and biochemical parameters of girls with menstrual irregularity of girls with menstrual irregularity
- Evaluate the effectiveness of a nurse-led intervention in improving biophysical, haematological, and biochemical parameters among adolescent girls with menstrual irregularities

METHODS

Study Design

This study followed a quantitative research approach and adopted a pre-experimental, one-group pre-test post-test design to evaluate selected parameters among adolescent girls with menstrual irregularities.

Participants and Sampling

The research was conducted at the Government Thoothukudi Medical College Hospital (GTMCH), Thoothukudi. The target population included all adolescent girls between 12 and 18 years of age attending the Gynecology Outpatient Department (OPD). Using a purposive sampling technique, a total of 20 participants were selected based on specific inclusion and exclusion criteria. The inclusion criteria consisted of adolescent girls aged 12–18 years who had attained menarche and were attending the Gynecology OPD. The exclusion criteria included those who had not yet attained menarche and those unwilling to participate in the study.

Data Collection Procedure

Data were collected using a structured tool composed of three sections: a demographic data sheet, a checklist to record the duration and pattern of menstruation and menstrual irregularities, and a BMI classification chart used to assess body mass index. Each participant was assessed during the pre-test and post-test periods using the same instruments to identify changes in physiological, hematological, and biochemical parameters over the study duration. Nurse-led interventions for menstrual disorders include educating women about the normal menstrual cycle, causes of abnormalities, and proper hygiene practices; providing guidance on diet rich in fruits, vegetables, iron, and calcium while limiting caffeine and sugary foods; teaching regular exercise and stress-reduction techniques like meditation; promoting good sleep habits; and distributing educational materials and supplements like iron to manage symptoms and improve overall menstrual health and knowledge effectively.

Statistical Analysis

Data were analyzed using SigmaPlot v14.0. Normality was tested using Shapiro–Wilk. One-way repeated measures ANOVA with Bonferroni post-hoc correction was applied ($p<0.05$).

RESULTS

Table 1 shows the socio-demographic and gynecological profile of girls with menstrual irregularities (n = 20). Most participants (70%) were aged 13–19 years and more than half (55%) attained menarche at 12–13 years. The majority had school education (65%) and belonged to lower-middle income families (45%). Half lived in nuclear families (50%) and 60% followed a non-vegetarian diet. Gynecological details show that 65% had irregular menstrual cycles, with more than 22 days cycle length reported by most girls. Moderate bleeding was noted in 70%, and 80% had menstrual flow lasting more than 3 days. Pain during menstruation was common, reported by 75% of participants, mostly of moderate severity. Overall, the findings indicate a high prevalence of irregular cycles associated with moderate flow and menstrual pain among adolescents.

Table 2 presents the analysis of physiological parameters in girls with menstrual irregularity across three visits. The results show a statistically significant reduction in body mass index (BMI) over time ($F = 5.690$, $P = 0.007$), indicating slight improvement in weight status. Other parameters including pulse rate, systolic and diastolic blood pressure, and respiratory rate showed no significant variation between visits ($P > 0.05$), suggesting stability in cardiovascular and respiratory function during the study period.

Table 3 summarizes the hematological findings across three visits. Significant changes were observed in haemoglobin ($F = 3.393$, $P = 0.044$) and white blood cell count ($F = 5.770$, $P = 0.006$), both showing gradual increases, which may reflect improvement in hematological status. However, platelet count and packed cell volume (PCV) did not exhibit significant differences among visits ($P > 0.05$), indicating stable blood volume and clotting potential.

Table 1: Socio-demographic and Gynecological Variables of Girls N = 20

S.No.	Parameter	Category	Number	Percent
1	Age (years)	10 – 12	6	30
		13 – 15	7	35
		16 – 19	7	35
2	Age at menarche (years)	12 – 13	11	55
		14 – 15	9	45
3	Education	No formal education	7	35
		School education	13	65
4	Family income (₹)	< 10,000	3	15
		10,001 – 20,000	9	45
		> 20,001	8	40
5	Religion	Hindu	11	55
		Other	9	45
6	Type of family	Nuclear	10	50
		Joint	10	50
7	Type of diet	Vegetarian	8	40
		Non-vegetarian	12	60
8	Type of Menstrual Cycle	Regular	7	35
		Irregular	13	65
9	Average days of the menstrual cycle	< 21 days	7	35
		> 22 days	13	65
10	Amount of bleeding	Scanty	4	20
		Moderate	14	70
		Heavy	2	10
11	Average days of menstrual flow	< 2 days	4	20
		> 3 days	16	80
12	Pain during menstruation	Yes	15	75
		No	5	25

Table 2: Physiological parameters of girls with menstrual irregularity N=20

S.No.	Parameter	Visit	Mean	SD	SE	Statistics
1	Body mass index (kg/m^2)	1st	34.5	7.8	1.7	F = 5.690
		2nd	33.9	7.6	1.7	P = 0.007
		3rd	33.4	7.4	1.7	
2	Pulse rate (beats/min)	1st	78.2	6.5	1.5	F = 2.611
		2nd	80.0	7.9	1.8	P = 0.087
		3rd	78.5	7.1	1.6	
3	Systolic blood pressure (mmHg)	1st	107.5	4.4	1.0	F = 0.769
		2nd	108.5	3.7	0.8	P = 0.471
		3rd	109.0	3.0	0.7	
4	Diastolic blood pressure (mmHg)	1st	72.0	5.2	1.2	F = 0.144
		2nd	73.0	5.7	1.3	P = 0.867
		3rd	72.5	7.1	1.6	
5	Respiratory rate (breaths/min)	1st	19.0	1.8	0.4	F = 0.517
		2nd	19.0	1.8	0.4	P = 0.601
		3rd	19.0	1.4	0.3	

Table 3: Hematological parameters of girls with menstrual irregularity N = 20

S.No.	Parameter	Visit	Mean	SD	SE	Statistics
1	Haemoglobin (g/dL)	1st	10.37	1.30	0.29	F = 3.393
		2nd	10.40	2.40	0.54	P = 0.044
		3rd	11.26	0.81	0.18	
2	White blood corpuscles (x103/cells/µL)	1st	6.56	1.7	0.38	F = 5.770
		2nd	6.67	1.5	0.34	P = 0.006
		3rd	7.04	1.4	0.31	
3	Platelets (x105/cells/µL)	1st	3.0	0.7	0.15	F = 1.905
		2nd	3.2	0.6	0.13	P = 0.163
		3rd	3.0	0.6	0.13	
4	Packed cell volume (%)	1st	35.0	3.5	0.8	F = 0.408
		2nd	33.0	7.5	1.7	P = 0.668
		3rd	33.5	8.5	2.0	

Table 4: Analysis of biochemical parameters of girls with menstrual irregularity

S.No.	Parameter	Visit	Mean	SD	SE	Statistics
1	Random blood sugar (mg/dL)	1st	85.6	9.2	2.1	F = 0.889
		2nd	83.9	5.7	1.3	P = 0.419
		3rd	83.5	7.0	1.6	
2	Total cholesterol (mg/dL)	1st	175	13.0	2.9	F = 2.522
		2nd	160	35.3	8.0	P = 0.094
		3rd	167.5	13.0	2.9	
3	Triglycerides (mg/dL)	1st	133	16.0	3.6	F = 4.991
		2nd	132	16.4	3.7	P = 0.012
		3rd	117	28.0	6.2	
4	Urea (mg/dL)	1st	26.0	7.1	1.6	F = 1.510
		2nd	27.3	4.2	1.0	P = 0.234
		3rd	26.1	5.2	1.1	
5	Creatinine (mg/dL)	1st	0.62	0.14	0.03	F = 0.251
		2nd	0.64	0.16	0.03	P = 0.780
		3rd	0.61	0.15	0.03	
6	Triiodothyronine; T3 (pg/mL)	1st	3.2	1.0	0.2	F = 4.540
		2nd	3.3	1.0	0.2	P = 0.017
		3rd	3.6	1.0	0.2	
7	Thyroxin; T4 (µg/dL)	1st	12.0	1.6	0.4	F = 0.203
		2nd	12.0	3.8	0.9	P = 0.817
		3rd	12.0	1.8	0.4	
8	Thyroid stimulating hormone; TSH (µU/mL)	1st	3.7	0.5	0.1	F = 0.259
		2nd	3.8	0.5	0.1	P = 0.773
		3rd	3.7	0.7	0.1	

Table 4 details biochemical parameters over the three visits. Significant differences were noted in triglyceride levels (F = 4.991, p = 0.012) and triiodothyronine (T3) (F = 4.540, P = 0.017), both showing improvement trends across visits. In contrast, random blood sugar, total cholesterol, urea, creatinine, thyroxin (T4), and thyroid stimulating hormone (TSH) did not show significant changes (p>0.05), indicating overall biochemical stability in these parameters.

DISCUSSION

The significant reduction in Body Mass Index (BMI) observed across follow-up visits highlights the efficacy of

targeted interventions in addressing weight-related issues among girls with menstrual irregularities. In connection with these findings, several studies emphasize the relationship between lifestyle modifications and BMI changes in similar populations.

Öberg *et al.* demonstrated that behavioral modification interventions led to improved menstrual function and reduced BMI in women diagnosed with polycystic ovary syndrome (PCOS), a condition frequently associated with menstrual irregularities [10]. This suggests that positive weight changes can occur alongside hormonal and physiological health improvements in girls facing similar health challenges.

Furthermore, Purba *et al.* [11] provide evidence of a correlation between overweight status and menstrual disorders in adolescent girls, reinforcing the notion that modifications in weight can lead to significant improvements in menstrual regularity. Different interventions, such as dietary changes or metabolic adaptations, can thus have a profound impact on both weight and menstrual health. This understanding aligns with the statistical significance observed in the current study regarding BMI reduction, indicating the potential benefits of addressing weight issues in this demographic. Interestingly, other physiological measures, such as heart rate and blood pressure, did not exhibit significant changes during the intervention, suggesting the stability of cardiovascular functions throughout the weight management process. This concurs with findings where cardiovascular parameters often remain unchanged, despite improvements in metabolic indices [12].

The stability of physiological parameters during weight reduction efforts may indicate a protective effect of gradual weight loss, making it a safer strategy for populations dealing with menstrual irregularities. The hematological results reveal marked improvements in hemoglobin and white blood cell counts, indicating enhanced blood health and immune status over time. This aspect is crucial as it demonstrates the physiological benefits that can arise from lifestyle changes.

A study by Hamed *et al.* discusses various metabolic and hormonal variables in women undergoing treatment for PCOS, which is often closely tied to weight management strategies [13]. Moreover, research has indicated that women with improved menstrual regularity also show enhanced blood parameters, emphasizing the interrelation of menstrual health and complete blood count indices [14]. The biochemical analysis indicating significant improvement in triglycerides and thyroid hormone (T3) levels adds a layer of complexity to the findings, suggesting positive metabolic adaptations. Li *et al.* [15] found that dietary interventions could improve various metabolic factors, showcasing that weight loss can effectively translate into altered biochemical markers relevant to health outcomes. However, this area requires nuanced consideration, as other studies highlight differing results regarding metabolic stability amid weight loss interventions [16, 17].

CONCLUSIONS

The study concluded that nurse-led interventions effectively improved the physiological, hematological, and biochemical status of adolescent girls with menstrual irregularities. It was observed that BMI reduction reflected positive lifestyle changes, while increased hemoglobin and WBC counts indicated improved hematologic health. A decrease in triglyceride levels showed favorable metabolic adjustment. Overall, the study concluded that targeted lifestyle and dietary interventions enhance menstrual health and general well-being among adolescent girls.

Ethical Statement

Ethical clearance was obtained from the Institutional Ethical Committee, and informed consent was secured from each participant prior to data collection.

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